3.5 DESCRIPTION OF OPERATIONS

3.5.1 Conduct of Operation

Facility operation is guided by Program Requirements Document PRD 102-02.0, "Conduct of Operations Program." Beam delivery within LANSCE is accomplished in accordance with the AOT-6 Operations Manual. Review and approval levels for each section are in accordance with a graded approach, as specified in Chapter 1 Section 4 of the manual. The manual is reviewed and updated at least every three years, as specified in Chapter 1 Section 4. SOPs pertinent to LANSCE operations are approved by the cognizant group and division leader and reviewed annually in accordance with LANL AR 3-4.

Experimenters must follow facility safety procedures and SOPs pertaining to experimental activities. Accelerator and beam delivery operation is directed from the Central Control Room (CCR) by the Accelerator Operations Group (AOT-6). The Accelerator Operations Group maintains detailed procedures for, and records of, operation. CCR maintains communication with experimental areas through the LANSCE paging system.

Chapter 2 of the AOT-6 Operations Manual follows the 5480.19 guidance and describes the group organization established to provide safe and reliable operation of the accelerator and beam delivery complex. Facility operations organization and administration is conducted in accordance with DOE Order 5480.25. Procedures are updated as necessary; at this writing, detailed procedures include the following:

Section Number	Title
2.1	Operations Organization and Administration
2.2	Shift Routines and Operating Practices
2.3	Control Room Activities
2.4	Communications
2.5	Control of On-Shift Training
2.6	Investigation of Abnormal Events
2.7	Notifications
2.8	Control of Equipment and System Status
2.9	Lockouts and Tagouts
2.10	Independent Verification
2.11	Logkeeping
2.12	Operations Turnover
2.13	Facility Chemistry and Unique Processes
2.14	Required Reading
2.15	Timely Orders to Operators
2.16	Operations Procedures
2.17	Operator Aids
2.18	Equipment and Piping Labeling

3.5.1.1 Modes of Operation

A “mode” as defined for beam operations is the delivery of beam to a specific destination. Each allowed beam destination has a named mode. Modes have either an intermediate beam plug for tuning or a final beam stop or target for production. Proper equipment lineup for a mode is enforced by the Run Permit interlock chain.

3.5.1.2 Readiness for Beam Delivery

Accelerator startup after any maintenance or recovery activity follows written procedures using checkoff-signoff sheets.

The most complete procedures are used after multi-month maintenance periods. The turn-on sequence includes equipment readiness reviews and interlock checkout. The readiness reviews are conducted by the Radiation Safety Committee and focus on shielding and barrier adequacy. The interlock checkouts are done by the area operating groups following detailed plans and are signed off by the responsible persons. When the reviews and checkoffs are complete, a higher-level checkoff sheet can be signed by the supervisory level and the equipment can be made ready. This is done sequentially for each run mode, starting with 750 keV operation and progressing to higher energies.

The checklist process is brought together at the highest level in the Master Administrative Checklist authorizing primary beam delivery in a run mode when signed by the Accelerator Operations Group Leader. An example is shown in Appendix 3-3.

3.5.1.3 Operations Log

Operations log requirements and procedures are detailed in the OpMan Section 2.11.

3.5.2 Safety Reviews and SOPs

3.5.2.1 Facility Safety Reviews

The facility safety review process begins as far in advance of the activity as is practicable. For significant changes, the process begins with the ES&H ID (identification) process administered by ESH-3. The ES&H ID process identifies applicable ES&H requirements which must be met, including safety documentation, NEPA, RCRA, and OSHA requirements, and seismic and fire protection reviews. ESH-3 forwards the results of the ES&H ID process to the initiator of the project and the TA-53 Facility Management organization for notification and subsequent action. The DOE Facility Representative (FR) at TA-53 is appraised of new activities through the TA-53 ES&H Council and contacts with the Facility Management organization.

General requirements for safety review and risk acceptance for accelerator facilities are given by DOE Order 5480.25. In addition, a TA-53 facility procedure provides a process for internal review of new or modified accelerator facilities. (Approval of user experiments is described in section 3.5.2.2.)

A modification or change which may impact the facility safety envelope or which raises issues not adequately addressed by this safety assessment is handled as an Unreviewed Safety Issue (USI) per DOE Order 5480.25. Further analysis or reviews are conducted to determined the impact of the change and any additional measures that would be necessary to mitigate risk. In accordance with the DOE 5480.25 Implementation Plan for TA-53, a USI determination procedure will be carried out. Activities that involve a USI are not performed until a USI is prepared, reviewed and approved.

To ensure that operations are conducted within the limitations of the facility safety envelope, safety-related procedures, including SOPs, are reviewed by the TA-53 ES&H Team Leader and are approved by the line manager responsible for the activity. In addition, TA-53 Facility Management and line managers conduct regular self-inspections to identify ES&H concerns or discrepancies.

3.5.2.2 Experiment Safety Reviews

The review of user experiments is a three-step process, conducted by the site Facility Management office, which ensures that experiment hazards have been adequately assessed, and that facility safety envelopes are maintained. The first step is collection of data from the user related to experiment safety. This is accomplished with checklists and standard forms that provide information on hazardous/ radioactive materials, cryogens, lasers, pressurized targets, shielding requirements, electrical power, and material handling.

The second step involves safety reviews, which are documented with records maintained by the host organization. MLNSC and WNR have developed review procedures appropriate to their user experiment programs.

The third step of the process is a safety walkthrough of the experimental setup. During this stage it is verified that the experiment incorporates the necessary safety requirements, including personnel training, protective equipment, and procedures. After all requirements have been satisfied, the host organization coordinates beam delivery to the experimental area and grants access control responsibilities to the user. Regular walkthrough inspections ensure that approved operations are conducted safely.

3.5.3 Automated Operational Control

Beam operation is directed from the Central Control Room by the accelerator operators. Steady-state normal operation is largely automatic. All beam control elements operate under their own servo-control loops to maintain operating tolerances. The facility status is monitored and displayed through the CCR control computer system, which reports exceptions to normal status to the operators. Critical machine parameters are also routinely monitored by the operators observing displays in the CCR.

Many machine parameters are also interlocked. The interlock chain can shut off equipment and beam for out-of-tolerance conditions.

The interlocks have a hierarchy illustrated in Figure 3-23.

3.5.3.1 Fast Protect

Fast Protect (FP) is the fast inhibit system for beam. Inputs include radiation detectors in the beam channels, the beam current loss monitoring system, RF amplitude and phase servo loop tolerance, and the Run Permit and Radiation Security Systems. FP action when faulted is to inhibit the beam-on gates to the injectors and deflectors within ~100 μs of the fault. This system is as beam-specific as the detectors allow: if H^- beam causes excessive beam channel radiation, only the gates intended for H^- beam are inhibited.

The primary function of FP is to minimize equipment damage and activation by excessive beam spill. It also stops beam delivery faster than beam plug insertion.
FP faults reset automatically when the fault condition clears.

Section 8.1 of the Operations Manual gives the procedure followed to defeat an FP input.

3.5.3.2 Run Permit

Run Permit (RP) is the interlock system enforcing proper equipment lineup for beam delivery. The upstream RP beam plugs are interlocked with downstream RP ready so that the beamline is blocked to an unready area. This prevents equipment damage and avoids an RSS challenge. RP also inputs to FP so that in addition to the beamline being blocked, beam gates are inhibited.

RP includes inputs from the following components:

- Vacuum valve positions, vacuum pressures
- Magnet power supplies, magnet currents
- Beam plug positions
- Temperature switches

- High voltage states
- Water flow switches
- Instrumentation device positions
- Ventilation states
- RSS states
- Isotope Production stringer positions
- Primary beam-line target drive states
- Radiation instrumentation

RP faults are latched and require operator action to reset.

Section 7.1 of the Operations Manual gives the procedure followed to defeat an RP input.

“Albatross” neutron detectors are widely deployed especially in those Line D areas that might be occupied during normal operation. The Albatross (Model 2080 Pulsed Neutron Detector, Appendix 3-5) is gamma-corrected, allowing a fairly accurate reading of neutron radiation in rem to be indicated, at least for neutrons below 20 MeV. This instrument is relatively complicated and has gone through several revisions to enhance its reliability. The Albatross provides a millirem output level readable by the accelerator control system. In the current system, Albatrosses provide a radiation-trip level to Run Permit as an “early warning” device rather than for personnel safety. The locations and trip level settings are documented in the Operations Manual Section 6.7 and are controlled by the Accelerator Operations Group. Requirements for locating the Neutron Detectors are established by the Operating Group for the area.

RM-16 neutron detectors are also deployed in the facility (Appendix 3-6). Typically these are set at fairly low levels (~10 mrem) and interlocked through Run Permit not with the intention of providing a level of personnel safety enhancement, but for early warning.

3.5.3.3 Radiation Security System

The Radiation Security System was described in Section 3.3.1.2.
RSS is a distinctly-layered system. The bottom layer, the Personnel Access Control System, prevents beam delivery in occupied areas and prevents personnel entry into areas with beam delivery. Under normal operation, it is adequate to ensure that operation is safe for personnel.

The errant beam monitoring layer helps minimize prompt and residual radiation. The RSS interconnection relays RSS fault conditions upstream and ensures that primary beam does not strike the downstream RSS plugs, until eventually the beam is inhibited or stopped by the venting plugs in the Low-Energy Transport.

The beam current limiter layer to RSS prevents excessive beam current delivery. The RSS radiation instrumentation layer prevents excessive beam losses along the beam transport lines, and excessive radiation in occupied areas.

The Operations Manual Chapter 1 Section 3.5 defines how authority to defeat an RSS input is granted. The procedure is described in the AOT-6 Operations Manual, Chapter 6, Section 1.

3.5.4 Operations Procedures for Normal Operation

Facility operation usually follows a well-established pattern with steps detailed in the Operations Manual. An operating period begins with a formalized equipment readiness checkout. After this, the beam delivery system will be lined up for one or more beam destinations and beam tuning commences sequentially through the facility according to a published plan. After low-power tuning and over a period of perhaps several days, the beam is brought up to the scheduled power level. Production beam delivery may then continue for a period of months with intervening scheduled maintenance periods and unscheduled downtimes. At the conclusion of scheduled operation, beam delivery is stopped, equipment is secured in an orderly fashion, and an extended maintenance period begins. Several weeks before restart of scheduled production, the cycle begins again.

Detailed procedures for beam tuning are updated frequently and are documented less formally in notebooks in CCR. The Accelerator Operations Group staff is the authoritative source for tuning procedures. One staff member is designated On-Call at all times during beam operation.

3.5.5 Emergency Preparedness

Site-specific emergency response procedures appropriate for the facility operators are detailed in the Operations Manual Chapter 4. The opening paragraphs state:

> 4.1 Emergency Response
>
> 4.1.1 Purpose
>
> 1. The purpose of this chapter [Emergency Response] is to provide guidance for immediate response to emergencies by AOT-6 Operations personnel.
>
> 2. This guidance is applicable only during scheduled turn-on and operating periods. During these periods the Central Control Room (CCR) is staffed and operations personnel are available to respond to mitigate the consequences of an emergency and assist in its investigation.

LANL maintains lab-wide emergency preparedness programs and structures.

3.5.5.1 Emergency Preparedness Plan

The Laboratory emergency preparedness program is documented in the LANL Emergency Management Plan (LA-12900). The EMP, combined with building-specific emergency plans, provides the requirements, procedures, and information necessary to ensure that emergencies are mitigated in an expeditious and efficient manner.

The EMP, based on the requirements of DOE 5500-series orders and applicable federal regulations, assigns responsibilities for the institutional emergency preparedness program, provides guidance for notification and categorization, outlines actions to assess and mitigate hazards and protect employees and the public, and states training requirements for emergency response personnel.

Building emergency plans provide building-specific information on building function, hazards, safety systems, communications, call-out lists, local emergency procedures, and evacuation and shelter areas. Preparation and maintenance of building plans is coordinated by the TA-53 Facility Management Office and the Laboratory's Emergency Management and Response (EM&R) group. Run sheets, which contain essential building information and are part of the building plans, are used by the on-duty EM&R emergency manager and the Los Alamos Fire Department (LAFD) when responding to a potential or actual emergency.

3.5.5.2 Emergency Response

Response to emergencies at the Laboratory is based on a coordinated program that utilizes the resources of EM&R, LAFD, the protective force contractor, ESH Division (for radiological protection, safety, industrial hygiene, and medical expertise), and specialized teams such as Hazardous Materials Response and Hazardous Devices. During a response to an emergency, these resources are directed by an on-scene control group under the direction of a trained Incident Commander at the incident location. Depending on the scope and hazards of an incident , the Laboratory's Emergency Operations Center (EOC) can be activated to provide the capability for Lab-wide command and control and interface with external agencies.

If an emergency occurs at any time during an accelerator operating period, the CCR shift supervisor acts as a local emergency coordinator until relieved by an AOT Division manager or professional emergency response personnel (normally EM&R or LAFD). Procedures for CCR support of emergency response actions, including notifications, communications, and criteria for continued beam operation, are contained in Chapter 4 of the AOT-6 Operations Manual. During maintenance periods, the Facility Manager or senior

person on the scene coordinates immediate actions until the arrival of emergency response personnel.

Notification of TA-53 employees in the event of an emergency affecting multiple organizations or buildings is coordinated by the TA-53 Facility Management office and is described in “TA-53 Emergency Notification” (53FMP 109-01). Instructions to employees, which may include evacuation or shelter-in-place, are transmitted through a telephone network and public address systems.

The response time from Fire Station 1 at TA-3 to TA-53 is 8 to 12 minutes. A “first responder” capability is provided by the approximately 25 percent of TA-53 employees who are trained in CPR and first aid. In addition, ESH-1 personnel at TA-53 have the capability for prompt response to radiological incidents.

Incident reporting per DOE 5000.3B is the responsibility of the Facility Manager or acting Facility Manager Designee. The Laboratory’s Occurrence Reporting Group, ESH-7, coordinates the submission of reports to DOE and subsequent approvals.

3.5.5.3 Evacuation

Procedures for building evacuations are addressed in a facility-wide procedure and include building sweeps and accounting for personnel. Evacuation of individual buildings would normally be initiated by a fire alarm, or in some cases, special alarms such as low oxygen alarms. A TA-53-wide evacuation is unlikely due to the lack of uncontrollable hazards that could blanket the entire area. EM&R and LAFD respond to all fire alarms, and EM&R is notified of other types of alarms and potential emergencies. Widespread evacuation or shelter-in-place actions would be coordinated by an EM&R or LAFD Incident Commander.

3.5.5.4 Training

A formal training program has been developed by EM&R, in accordance with Director’s Policy 109, LANL’s Emergency Management Plan (EMP), and DOE 5500 series Orders, for the instruction and qualification of Laboratory emergency response personnel, including EM&R emergency managers, the Crisis Negotiation Team, Hazardous Materials Response Team, and Hazardous Devices Team. LAFD, operated by Los Alamos County, maintains a training program for firefighting, rescue, and emergency medical technician personnel. Emergency response personnel, including LAFD, are periodically given TA-53 orientation tours by the TA-53 Facility Management Office.

TA-53 personnel are trained in building evacuation procedures during annual fire alarm/evacuation drills. Additionally, TA-53 facility-specific training, provided to

employees and unescorted visitors, contains information on alarms, evacuations, and notifications. The training plan for TA-53 building managers includes courses in management of emergencies.

3.5.5.5 Drills and Exercises

Drills and exercises are conducted as part of the Laboratory's emergency preparedness program to develop, maintain, and demonstrate skills, expertise, and emergency response capability. The "Laboratory Drill and Exercise Manual" (Bequette 1992) provides guidance for conducting and evaluating drills and exercises.

Drills are scheduled and planned activities which test limited portions of the LANL Emergency Management Plan, implementing procedures, and building emergency plans. The most common type of drill at TA-53 is the annual fire alarm/evacuation drill conducted for each building. Tabletop or field response drills may be conducted to test the planning, procedures, or response for specific emergency scenarios.

Exercises are larger in scope and test the ability and capability of the LANL emergency response organization to respond to and mitigate emergency situations. Exercises simulate a real-world environment as much as possible, and participants are expected to react as they would in a real emergency situation while following safety and security requirements and regulations.

Except for the usual alarm-response building evacuation drills, no drills or exercises specific to LANSCE have been conducted, because no safety benefit related to operational hazards has been established.

3.5.6 Training

Laboratory-wide ES&H training requirements are developed by ESH-13. Line organizations define, deliver, and document training in compliance with Laboratory training standards outlined in the LS 113 series. The TA-53 Facility Management organization provides facility-specific training for all employees and unescorted visitors at TA-53. Laboratory-wide ES&H training for employees is tracked by the employee's line organization. Visitors to TA-53 who perform work for the Department of Energy or who use DOE facilities are subject to LANL training requirements. Anyone who works at the Laboratory is designated as a worker regardless of whether that person is a University of California employee, sub-contractor, or visitor.

In general, ES&H training requirements applicable to TA-53 workers are specified by the following:

- DOE Order 5480.25, Safety of Accelerator Facilities
- Occupational Radiation Protection (10 CFR 835) and LANL Radiological Control Manual
- Occupational Safety and Health Administration (OSHA) requirements (29 CFR)
- EPA Requirements (40 CFR)
- DOT Requirements (49 CFR)

Only trained and qualified individuals are assigned to perform tasks which could affect safety and health conditions at the facility (in particular, accelerator operations). This also holds true during commissioning and during development programs at the facility. Trainees are directly supervised by a qualified operator.

3.5.6.1 Facility-Specific Training Requirements

All personnel working at TA-53 are required to complete basic facility-specific training that will be updated to include safety envelope information after approval of this SAD. Training plans outline specific training requirements based on the worker's category, i.e., resident, occasional site worker, User (Experimenters), or visitor.

3.5.6.1.1 Residents and Occasional Site Workers

Generally, residents and occasional site workers must complete the Laboratory General Employee Training (GET) program and TA-53 facility-specific training. Retraining is required every two years for facility-specific training. Workers who access Controlled Areas unescorted must pass the GET written examination in order to comply with 10 CFR 835 requirements for General Employee Radiological Training (GERT) (unless they are currently qualified as a Radiological Worker I or II). Restesting is required every two years for GERT.

3.5.6.1.2 Users

LANSCE users (present for more than 10 days) are required to complete GET training, facility-specific training, and, if unescorted access to Controlled Areas is needed, they must pass the GET examination (unless they are qualified as a Radiological Worker I or II). LANSCE Users (at the facility for 10 days or fewer) who require unescorted access to Controlled Areas unescorted can have the GET (GERT) examination requirement waived, but must take the TA-53 facility-specific training, and read the GERT Refresher booklet (unless they are currently Radiological Worker I or II qualified). Any user who refuses to complete required training and who does not have a training waiver in place will not be issued a TLD badge and will not be permitted unescorted access to the facility.

3.5.6.1.3 Visitors

Escorted visitors on official tours of TA-53 are provided with radiation protection information. The visitors read and acknowledge the information and provide identifying information to enable the Training Office to document the receipt and review of the radiological information on EDS (Employee Development System; see section 3.5.6.3). Written records of visitor training are retained by the TA-53 Training Office.

Unescorted visitors who will be entering TA-53 radiological areas are required to complete facility-specific training and must be either GERT or Radiological Worker qualified, depending on the radiological area.

3.5.6.2 Training Qualification Programs

The Laboratory requires formal qualification or certification for certain job positions or job tasks. The Environment, Safety and Health Division provides training qualification and certification programs for certain identified job duties, including Radiological Worker, Forklift Operator, and Crane Operator and Rigger. Workers at TA-53 must meet qualification requirements identified by the Laboratory for those general tasks and that apply to their jobs. In addition, DOE Order 5480.25, “Safety of Accelerator Facilities,” identifies three categories for workers that require formal qualification in order to perform their work. These are Accelerator Operator, Accelerator Maintenance Personnel, and Users.

Qualification is defined in terms of education, experience, training, and any specific requirements necessary for performance of assigned responsibilities.

Managers, together with the training staff, establish qualification requirements. Some of the training required for initial and continuing qualification is addressed in training sponsored by the Environment Safety and Health Division, Group ESH-13. Additional training is provided as on-the-job training by the responsible group.

The AOT Division Training Office oversees the design and development of the qualification programs for accelerator maintenance personnel and accelerator operators. The qualification program for maintenance personnel is based on a graded approach that considers operating procedures and determines training and need for additional training. Workers are qualified through the use of checklists and training and an evaluation is conducted by designated on-the-job training instructors in the field. The qualification program for accelerator operators is a formal training program consisting of an initial qualification comprising four levels, and a continuing qualification program consisting of a comprehensive, periodic reevaluation of knowledge and performance requirements. Qualification program documentation is maintained by the AOT Division Training Office.

3.5.6.2.1 Job-Specific Training

Line managers are responsible for identifying job-specific training for workers under their supervision. It is the line manager's responsibility to develop individual training plans for employees within their organizations with assistance from their organization’s training specialist or training records manager through the use of a questionnaire process. The line manger is responsible for determining the level to which an individual worker must be trained relating directly to the job tasks of that individual worker.

Line managers allow only trained personnel to operate hazardous equipment, handle or transport hazardous materials, or perform operations within their areas of responsibility.

3.5.6.3 Training Records Management

Individual training records are maintained electronically on the official Laboratory training database, the Employee Development System (EDS). Training course/program records containing documentation applicable to program analysis, design, development, implementation, and evaluation are maintained by the AOT Training Office.

EDS is the official training database for training records management. Access to EDS is controlled; computer access is available to only those personnel who are authorized in the Laboratory’s Electronic Authorization System.

The ES&H Training Group, ESH-13, maintains course documentation for Laboratory-wide training courses and is responsible for entering the data into the EDS. The AOT/ TA-53 Training Office is responsible for entering facility-specific training data into the EDS for all workers completing the training.

3.5.6.3.1 Course Documentation

The TA-53 Training Office maintains records of facility-specific training that is provided. In accordance with Training Records Documentation (LS 113-01), the following documents are retained by the AOT training office:

- Content outline for each course and/or objectives for each course
- Course design information or On-the-job Training documentation forms
- Training attendance rosters
- Instructor qualification records
- Course evaluation instruments

Documentation of on-the-job training is required. OJT consists of Hands-On Training, and Required Reading. Appropriate documentation forms are provided by the TA-53 Training Office.

3.5.7 TA-53 Access Control

TA-53, the LANSCE site, is bounded by a chain-link fence and natural barriers. Normal access is through a vehicle/pedestrian check point and requires a recognized badge.

Access to TA-53 is controlled at the entrance station (MPF-1145) to the site for U.S. Department of Transportation compliance purposes. The entrance station is attended during work days. After normal work hours and on weekends and holidays, the gate is closed but can be opened by using the badge reader. Vehicle drivers must slow to allow the gate attendant to see a recognized badge. At least one vehicle occupant presents a recognized badge so that the gate attendant can easily see it. Badged employees take safety responsibility for unbadged persons accompanying them. Pedestrians and bicyclists must also present a recognized badge. Gate attendants allow immediate access to emergency vehicles displaying flashing lights without requiring occupants to show a badge.

During normal working hours there is no exit control. After hours and on weekends, the badge reader must be used to operate the exit gate. The Laboratory Protection Force can conduct vehicle searches at any time.

Any user who refuses to complete required training and who does not have a training waiver in place will not be issued a TLD badge and will not be permitted unescorted access to the facility.

3.5.8 Configuration Control

The description of the facility and operations is current at the date of writing but both undergo continuous evolution. Configuration control in various forms employed to ensure that the operating configuration is as currently intended and follows applicable standards. This section summarizes these activities.

Significant facility modifications go through the Laboratory risk management process as described in Section 3.5.2.1 above. A modification which does not impact the Safety Envelope can be implemented; otherwise, it is handled as a USI.

New kinds of experimental arrangements go through the experiment review process managed by the site Facility Management office, as described in Section 3.5.2.2. Laboratory resources are employed to review specific kinds of hazards in experiments. These resources include availability of expert groups such as the Electrical, Gas, Pressure Vessel, Laser, Tritium, Explosives, and Bio- Safety Committees. Special Nuclear Material controls are described in Section 3.3.2. Routine experimental arrangements receive a lower level of review.

The beam delivery configuration is reviewed by the operating groups. Group AOT-6 maintains and follows procedures in the LANSCE Operations Manual which cover equipment readiness and checkout, as described in Section 3.5.1.2 and Appendix 3-7. This includes periodic safety system checkouts. In addition, the TA-53 Radiation Safety Committee performs readiness reviews before startup following multimonth maintenance periods. This function emphasizes overall physical configuration readiness.

ESH Division particularly through the onsite radiation control group continuously monitors radiological conditions and exclusion area security, as described in Section 3.4.1.3. ESH reviews and locates various kinds of detectors for personnel safety and environmental protection.